

Water-Borne Outbreak of Brucella Melitensis Infection

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AN outbreak of at least 80 cases of brucellosis with 1 death occurred on the campus of Michigan State College, East Lansing, during December, 1938, and January, 1939. All persons attacked were either students in bacteriology or were associated with the bacteriology building during December. In the basement of this building there is a laboratory devoted to the study of brucella organisms and the production of "brucellin" and other materials for diagnosis and treatment of brucella infection. Prior to February 4, on which date the authors were requested to participate in the investigation, it had been demonstrated by the college authorities that several persons were infected with *Brucella melitensis*, giving positive blood cultures.

tory of an onset with chills, severe headache, and intermittent fever, followed in a few days by increasing weakness, general myalgia, anorexia, insomnia, nausea, constipation, high fever, and delirium. In several there was a particularly troublesome bronchitis resembling that associated with influenza. There were some subclinical or latent cases with a history of only transitory malaise or no symptoms at all, discovered only by laboratory examinations. A few of the latter had positive blood cultures but gave no history or evidence of being ill. Confirmation of diagnosis was available for the 80 cases reported. A summary of the laboratory findings is shown in Table I.

DIAGNOSIS

The majority of patients gave a his-

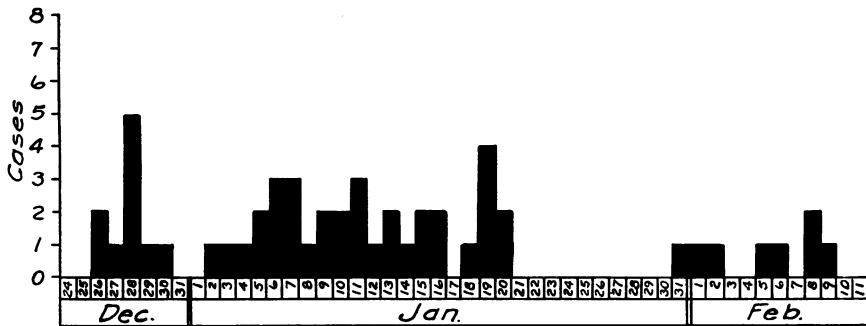
EPIDEMIOLOGY

The distribution of the cases by dates of onset is shown graphically in Figure I.

TABLE I
Laboratory Findings

<i>Blood Culture Br. Melitensis</i>	<i>Agglutination</i>	<i>Skin Test</i>	<i>Phagocytosis</i>	<i>Totals</i>
X	X	X	X	35
	X	X	X	40
		X	X	5
Totals 35	75	80	80	80

FIGURE I



Eleven gave a history of having had chills, headache, and fever during the Christmas holidays and several students appeared at the college hospital for treatment on the day classes were resumed after vacation. The onset of undulant fever is characteristically insidious and many of the patients were uncertain of the actual date on which illness began. There is evidence, however,¹ that the incubation period varies widely and this probably accounts for the distribution shown in Figure I. There were 210 students enrolled for laboratory courses in bacteriology during the first semester, divided into 8 classes, all taking the introductory course and working with non-pathogenic bacteria exclusively. These classes worked in the laboratories on the second and third floors of the build-

ing on the days and time schedule indicated in Table II.

It will be noted that frank clinical illness was present in 37, and 28 were latent or subclinical. The attack rate varied with each class but out of a total exposure, in the regular laboratory classes, this rate was 30.9 per 100. Only one clinical case occurred among students in classes 2 and 3, but no information could be obtained from college authorities relative to laboratory data as to whether it was obtained for the members of these classes.

In addition to the 65 cases in the regular classes 15 other cases occurred. Ten of these were students in other courses who used the same laboratories as the regular students for special assignments in parasitology, poultry pathology, etc., one a plumber who

TABLE II

Student Data

Class	Time Schedule	Location of Laboratory	No. in Class	No. Infected		Attack Rate Per cent
				Frank	Latent	
1	M-F 8-10	2 Floor	28	9	3	42.8
2	M-W-F 10-12	2 "	32	?
3	M-W-F 1-3	2 "	31	1	..	?
4	T-T-S 8-10	3 "	9	1	2	33.3
5	T-T-S 10-12	3 "	20	1	..	5.0
6	M-W-F 3-5	3 "	34	9	12	61.7
7	M-W-F 10-12	3 "	33	14	8	66.6
8	M-W-F 1-3	3 "	23	2	3	21.7
Totals			210	37	28	30.9

worked in the building; one a stenographer employed in a library on the second floor; one a stockroom attendant; one a student who paid social visits to a friend in one of the regular classes; and one a salesman who made but one visit to the building on December 13.

The history of this salesman is worthy of special comment. His date of onset was January 14, making an incubation period of 32 days. He went to bed January 19, and a definite diagnosis was made February 6. A blood culture taken February 6 showed *Brucella melitensis*. It was thus quite definitely established that the exposure of the patients took place about the middle of December.

Every case found to be infected with Brucella melitensis had been in the bacteriology building during the month of December.

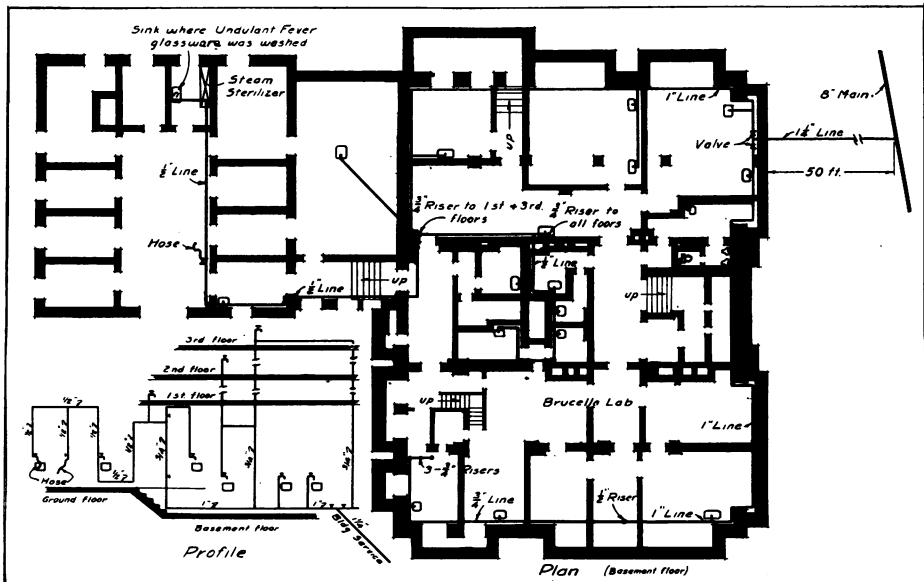
Complete histories were obtained on all clinical cases. None had had any contact with goats or goats' milk. There was no correlation in regard to living quarters, milk supply or other

dairy products, restaurants, banquets or dinners. All evidence pointed to a source of infection which could only have been present in the bacteriology building and common to all who became infected.

Only a few of the patients had ever been in the brucella laboratory in the basement. There was no evidence that any of the cultures of brucella organisms from that laboratory had been taken to the laboratories used by the students. One possible medium which could have been a disseminator of the bacteria was water through the service within the bacteriology building.

The building is quite old and unsuitable architecturally for its purpose. Adaptation of the plumbing system to meet the demands of greatly augmented numbers of students during the past several years has greatly exceeded the capacity of the service. (See Figures II and III). It will be noted that the building's water supply is obtained from the college distributing system through a 1 1/4 inch service pipe approximately 50 feet long. Immediately

FIGURE II



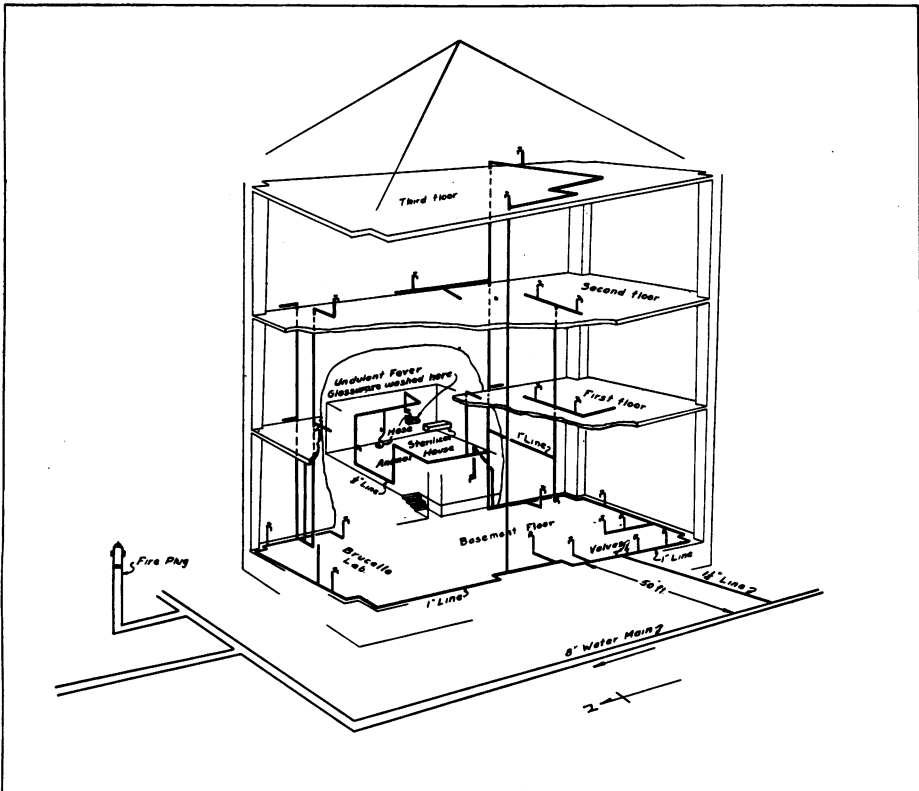
inside the building there is a T coupling diverting the water into two 1 inch lines which extend around the building in opposite directions but do not reconnect. One inch risers serve the first, second, and third floors.

It was a custom of the brucella laboratory to place discarded cultures contained in Petri dishes and culture tubes in copper containers of about 1 cubic foot capacity. These were packed full, a tight fitting cover adjusted, and placed in an Arnold sterilizer. At the end of 1 hour's exposure to steam the dishes were removed, media scraped out, and the glassware washed in a nearby sink. As a test of the effectiveness of this sterilization we carried out the following procedure: On removal of the copper container after 1

hour it was found that the glassware could be comfortably handled immediately and that the agar media was not even melted. It was obvious that the method was entirely inadequate for sterilization of cultures.

The custom followed in washing the glassware was as follows: After the media was discarded the glassware was put in a large dishpan in the sink, the dishpan filled with water, and after a period of soaking the glassware washed. A piece of rubber tubing connected to the faucet was used to prevent breakage. When the dishpan was filled this tubing extended below the surface of the water in the dishpan. The possibility of siphonage if a negative pressure obtained in the water system was apparent.

FIGURE III



DEMONSTRATION OF SIPHONAGE

By opening several faucets in the basement a negative pressure was produced in the faucet at the sink where the glassware was washed. A pressure recorder on the third floor showed a negative pressure equivalent to 2 inches of mercury when all outlets in the basement were allowed to remain open. A solution of fluorescein was placed in a container in the sink used for washing glassware and after a negative pressure was produced at that point the dyed water was siphoned into the water system. After the dye had reached beyond the riser pipes to the upper floors the pressure was again returned to positive, and green water was obtained from every outlet in the building.

Referring to Figure III it will be noted that one of the riser pipes supplying the third floor is connected with the line supplying the sink where the glassware was washed. This allowed for more direct water communication between this sink and the third floor laboratory. Considerably more pipes would need to be traversed by contaminated water to reach the first and second floors. This fact may have been

responsible for the higher percentage of infected students among those using the third floor than among those using the second floor.

A new sink and 2 autoclaves were installed in the building during December. The water main outside the building had been tapped for a service to a new building nearby. Thus, in addition to the possibility of negative pressure being created by the simultaneous opening of a number of outlets in the building, there were additional possibilities when the water was shut off during these installations.

SUMMARY

1. An outbreak of 80 cases of infection with *Brucella melitensis*, with 1 death, occurring at Michigan State College, East Lansing, Mich., is reported.
2. All cases occurred in students and others using a bacteriology building which contains a laboratory that handled large numbers of brucella cultures.
3. A faulty technic of sterilization of discarded cultures was demonstrated.
4. Inadequate and faulty plumbing was found in which siphonage could be produced from the point where contaminated glassware was washed.

REFERENCE

1. Hardy, A. V., Frant, S., and Kroll, M. M. The Incubation Period in Undulant Fever. *Pub. Health Rep.*, May 20, 1938, pp. 796-803.